WSDOT Roundabout Design/Construction Considerations

WSDOT PE Meeting

March 20-22, 2006

Brian Walsh, P.E.

WSDOT Highways and Local Programs Division

What is a Roundabout?

Or conversely….

What isn’t a Roundabout?

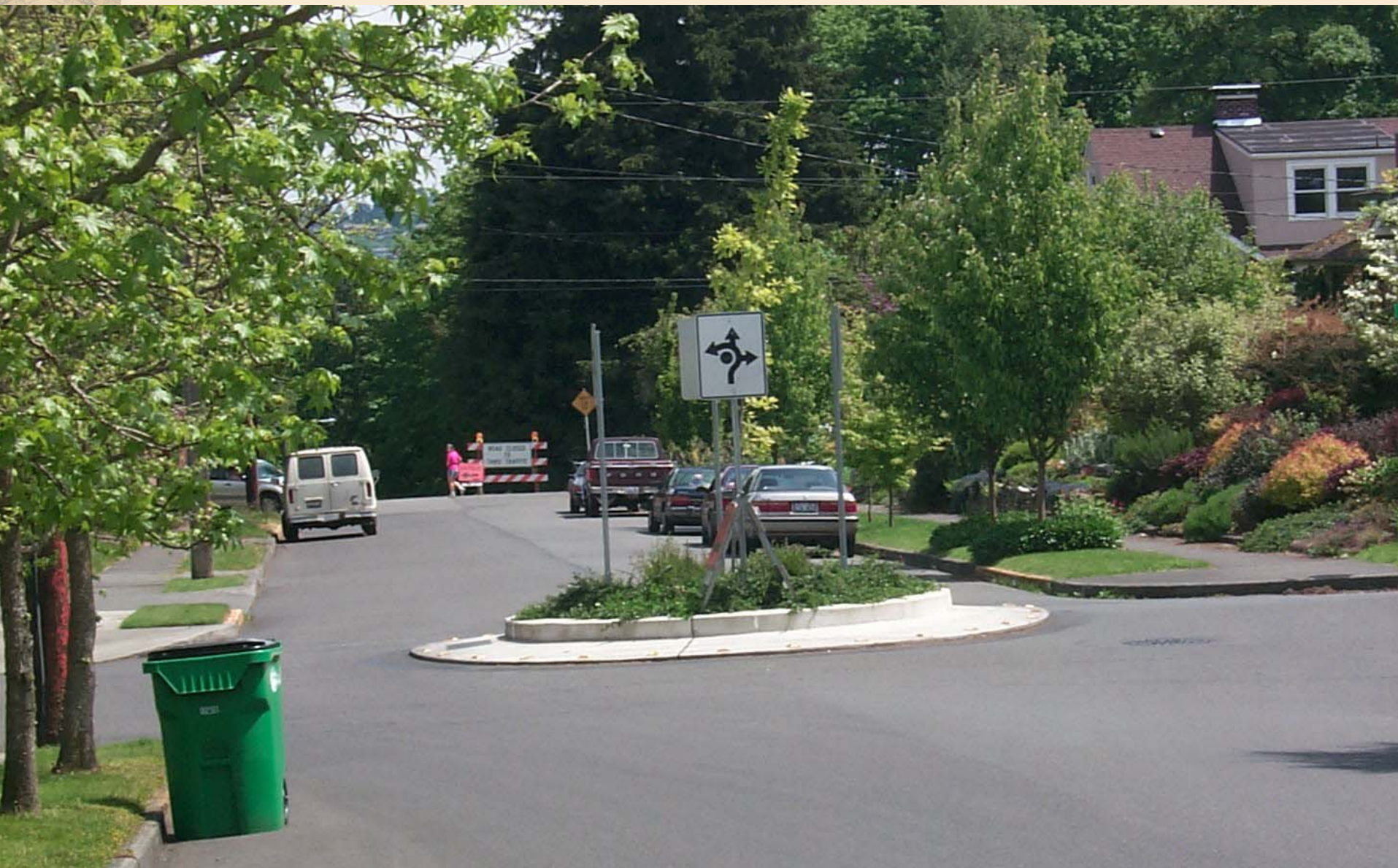
Roundabout “qualifiers”

- “Yield” at entry, counter-clockwise rotation
- Splitter islands…..to force CCW rotation
- Central Island……to achieve deflected paths

Traffic Circle or Roundabout ?


ONLY

Neighborhood Traffic Calming Circle




FT VANCOUVER WAY
E EVERGREEN BLVD
STOP
ONE WAY
ONLY
FORT VANCOUVER

Good Ole US of A

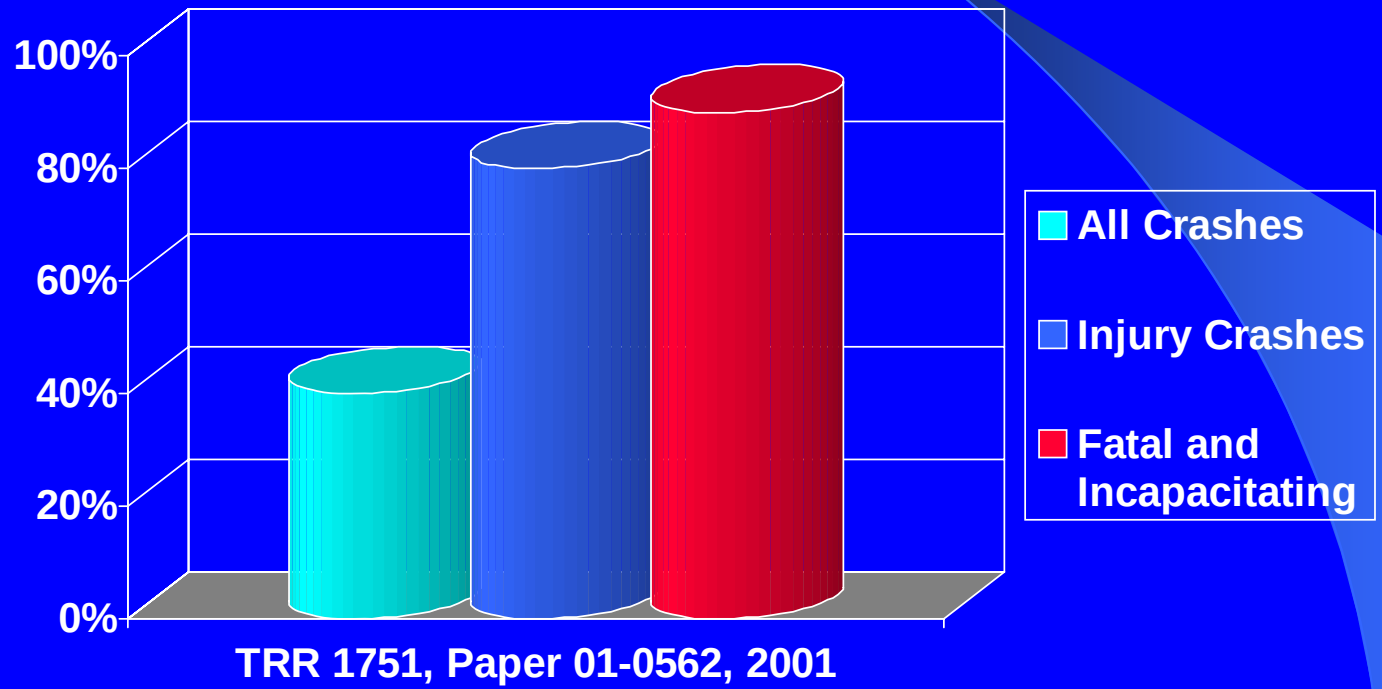
- Legoland Kids Driving with signals and stop signs!

Swiss Transportation Museum

- A roundabout kids are using in Europe

Safety

Crash reductions at 23 U.S. Roundabout Conversions



TRR 1751, Paper 01-0562, 2001

Safety Effect of Roundabout Conversions in the United States

Empirical Bayes Observational Before-After Study

Retting, Luttrell, and Russell November 2001

Public Opinion	Before Construction	After Construction
• Strongly opposed	41%	15%
• Opposed	14%	13%
• Favoring	31%	63%

"Public Opinion and Traffic Flow Impacts of Newly Installed Modern Roundabouts in the United States"

Quinault Drive/I-5 Off-ramp

Bethel Avenue/ SR 166

Tester Road/SR 522 Off-ramp

Bruce Road/ SR 206

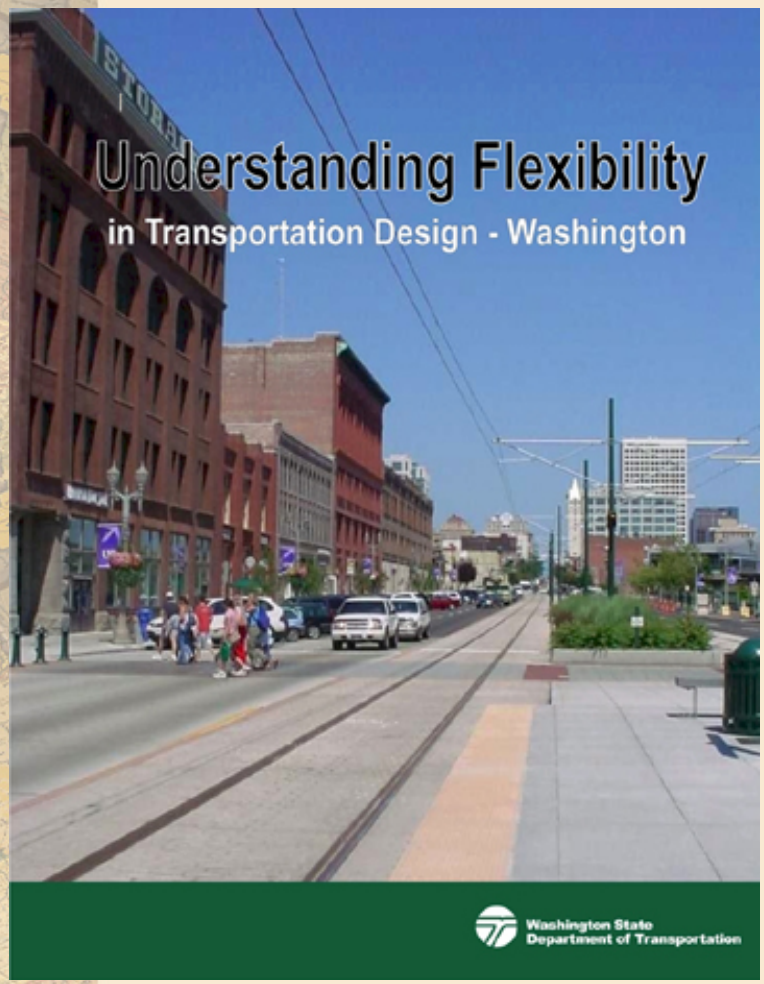
Bullfrog Road/ SR 903

Steptoe Drive/ SR 240

124th (Novelty Hill)/SR 203

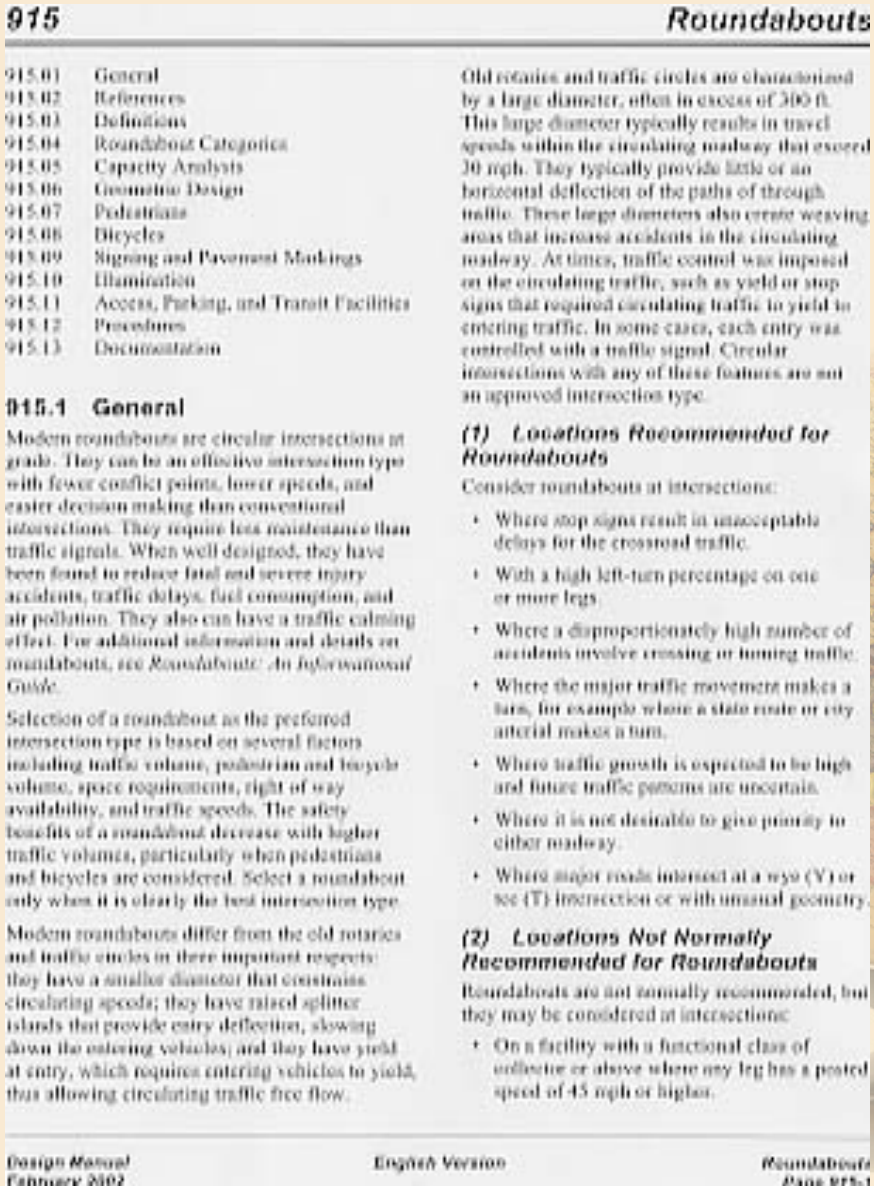
Vancouver, WA

Flexibility Document



http://www.wsdot.wa.gov/eesc/design/Urban/Default.htm

Design Manual Chapter 915



915 Roundabouts

915.01 General
915.02 References
915.03 Definitions
915.04 Roundabout Categories
915.05 Capacity Analysis
915.06 Geometric Design
915.07 Pedestrians
915.08 Bicycles
915.09 Signing and Pavement Markings
915.10 Illumination
915.11 Access, Parking, and Transit Facilities
915.12 Procedures
915.13 Documentation

915.1 General

Modern roundabouts are circular intersections at grade. They can be an effective intersection type with fewer conflict points, lower speeds, and easier decision making than conventional intersections. They require less maintenance than traffic signals. When well designed, they have been found to reduce fatal and severe injury accidents, traffic delays, fuel consumption, and air pollution. They also can have a traffic calming effect. For additional information and details on roundabouts, see *Roundabouts: An Informational Guide*.

Selection of a roundabout as the preferred intersection type is based on several factors including traffic volume, pedestrian and bicycle volume, space requirements, right of way availability, and traffic speeds. The safety benefits of a roundabout decrease with higher traffic volumes, particularly when pedestrians and bicycles are considered. Select a roundabout only when it is clearly the best intersection type.

Modern roundabouts differ from the old rotaries and traffic circles in three important respects: they have a smaller diameter that constrains circulating speeds; they have raised splitter islands that provide entry deflection, slowing down the entering vehicles; and they have yield at entry, which requires entering vehicles to yield, thus allowing circulating traffic free flow.

Old rotaries and traffic circles are characterized by a large diameter, often in excess of 300 ft. This large diameter typically results in travel speeds within the circulating roadway that exceed 30 mph. They typically provide little or no horizontal deflection of the paths of through traffic. These large diameters also create weaving areas that increase accidents in the circulating roadway. At times, traffic control was imposed on the circulating traffic, such as yield or stop signs that required circulating traffic to yield to entering traffic. In some cases, each entry was controlled with a traffic signal. Circular intersections with any of these features are not an approved intersection type.

(1) Locations Recommended for Roundabouts

Consider roundabouts at intersections:

- Where stop signs result in unacceptable delays for the crossroad traffic.
- With a high left-turn percentage on one or more legs.
- Where a disproportionately high number of accidents involve crossing or turning traffic.
- Where the major traffic movement makes a turn, for example where a state route or city arterial makes a turn.
- Where traffic growth is expected to be high and future traffic patterns are uncertain.
- Where it is not desirable to give priority to either roadway.
- Where major roads intersect at a wye (Y) or tee (T) intersection or with unusual geometry.

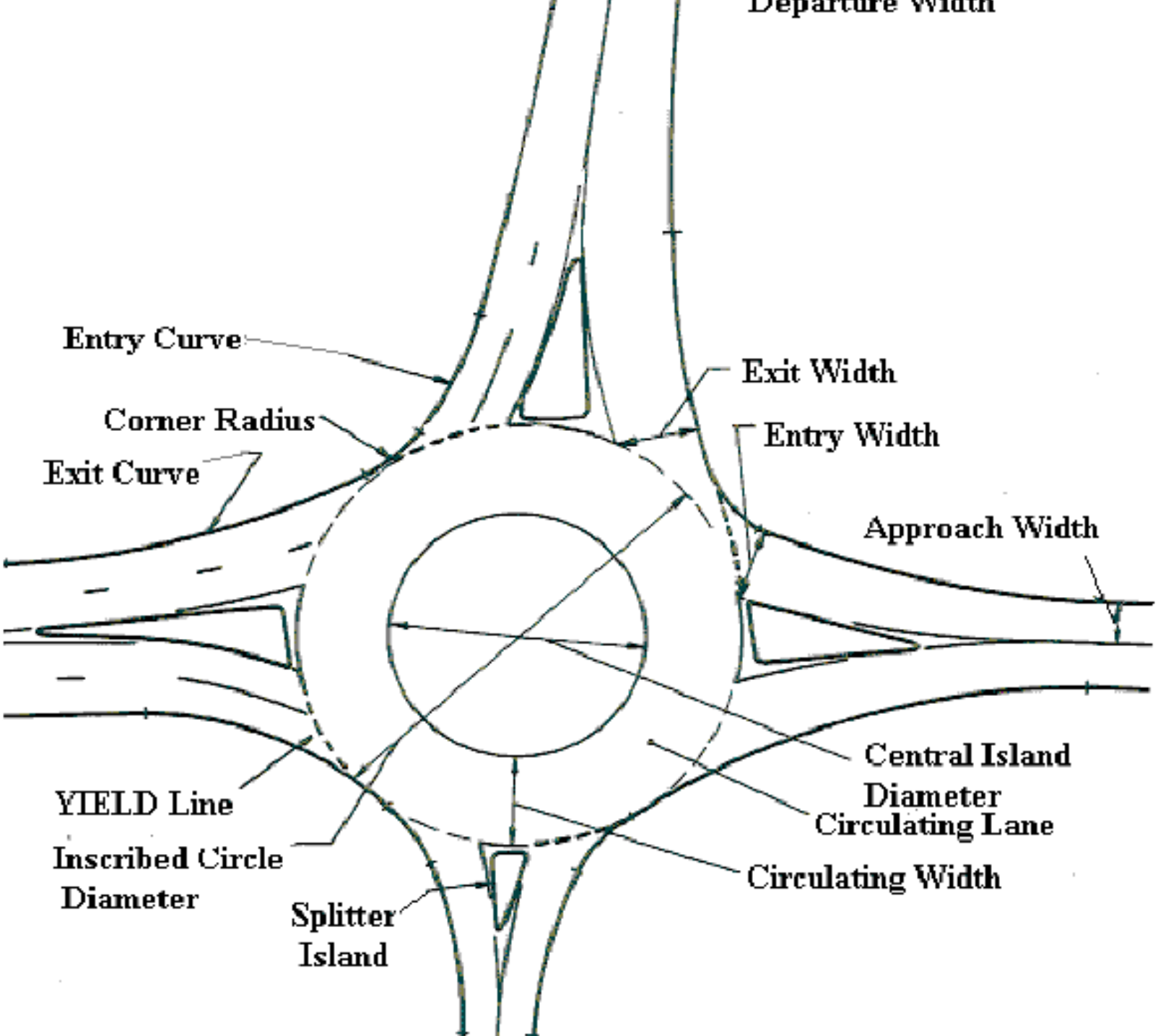
(2) Locations Not Normally Recommended for Roundabouts

Roundabouts are not normally recommended, but they may be considered at intersections:

- On a facility with a functional class of collector or above where any leg has a posted speed of 45 mph or higher.

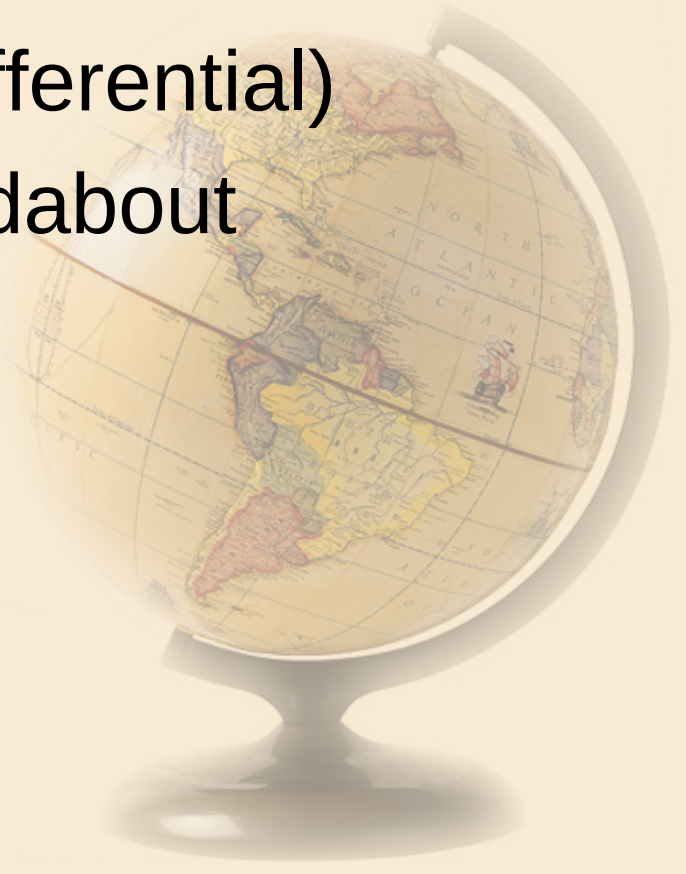
ROUNDABOUTS:
AN INFORMATIONAL GUIDE

U.S. Department of Transportation
Federal Highway Administration
Publication No.
FHWA-RD-00-067


Departure Width
Entry Curve
Exit Width
Corner Radius
Entry Width
Exit Curve
Approach Width
Central Island
Diameter
YIELD Line
Circulating Lane
Inscribed Circle
Diameter
Circulating Width
Splitter
Island

Design Considerations

- Inscribed Diameter
- Function of Splitter Islands
- Rural or Urban (Speed Differential)
- Single or Multi-lane Roundabout



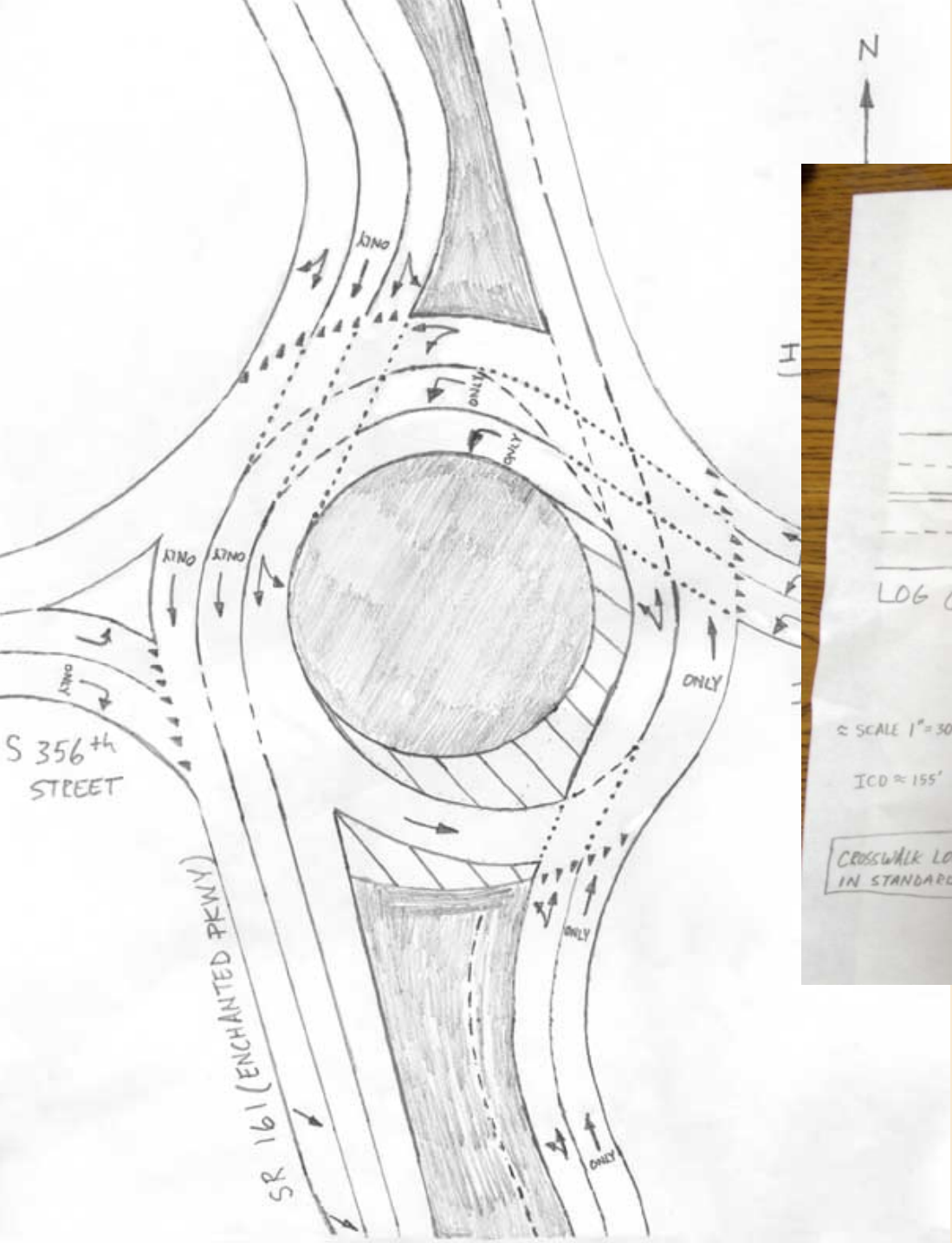
Step by Step Process

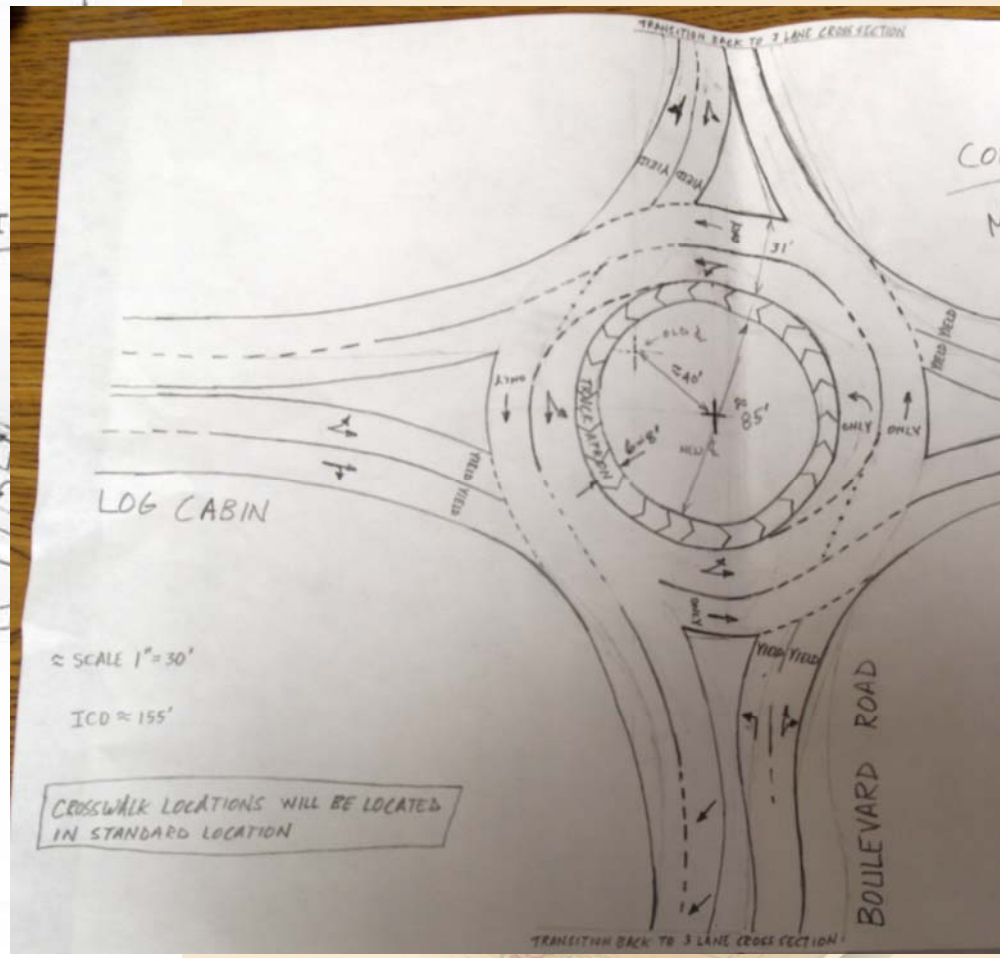
- Solid Capacity Analysis (aaSIDRA)
- Compatibility with Site/Scoping
  - Various Inscribed Diameter Sizes
  - Non-circular shapes
  - Future Road Network

- *Goal is a Conceptual Drawing before any real CADD work*

Getting to a Conceptual Drawing

- Plan Sheet with Scale
  - Single lane or Double lane (determined by analysis
  - Approach connections
  - Refinements
    - Sidewalk with buffer zones
    - Bike lanes starts and termination scenario’s
    - Landscaping of entire intersection/sight lines
    - Pavement markings
    - DRAFT or CONCEPTUAL clearly written or stamped on plan


N
ONLY
S 356th STREET
SR 161 (ENCHANTED PKWY)


TRANSITION BACK TO 3 LANE CROSS SECTION
YIELD
31'
ONLY
LOG CABIN
≈ SCALE 1" = 30'
ICD ≈ 155'
CROSSWALK LOCATIONS WILL BE LOCATED IN STANDARD LOCATION
BOULEVARD ROAD
TRANSITION BACK TO 3 LANE CROSS SECTION

Roundabout & Signal Options at
Boulevard and Log Cabin Road Intersection

Design
Viz

Common Design Challenges

- Splitter Island design – particularly the left side entry curve and its arc length
- Alignment of entries to minimize driver inputs in steering column
- Exit paths
- Truck Apron – Mountable Curb Design
- Overall Speed Path Consistency
- R1, R2, R3 relationships

Entry Curves


8/4/2004


8/4/2004


11/20/2003


WELCOME
MONROE
YIELD YIELD
4/11/2003

Context in which “they” are placed

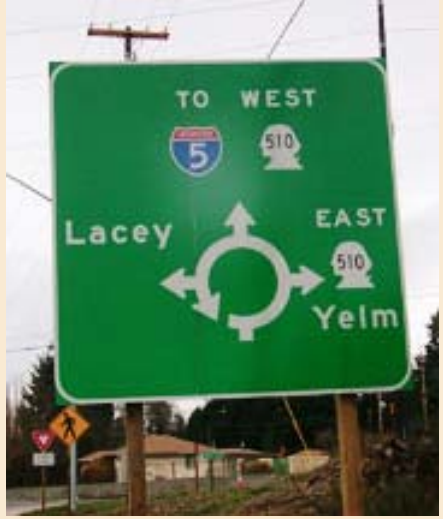
Exit Paths

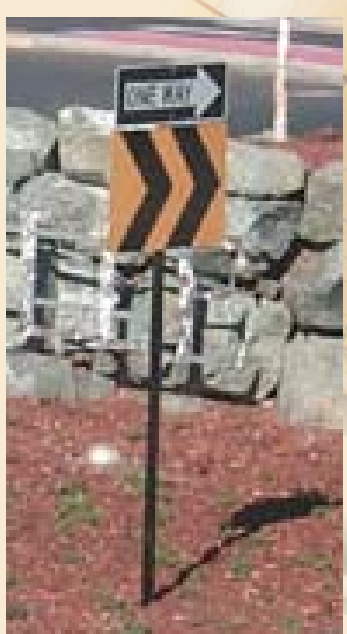
Truck Apron Curb


YIELD
TO TRAFFIC
IN ROUNDABOUT
7/16/2002


YIELD
TO TRAFFIC
IN ROUNDABOUT
7/16/2002

Essential Signing at Roundabouts





Construction Issues

- Traffic Control Staging
- How do we pave under traffic
- Amount of flagging necessary

Myths that public has bought into when a proposed Roundabout is shown to them

Turn left at entry – wrong way

A truck can’t go through the Roundabout!

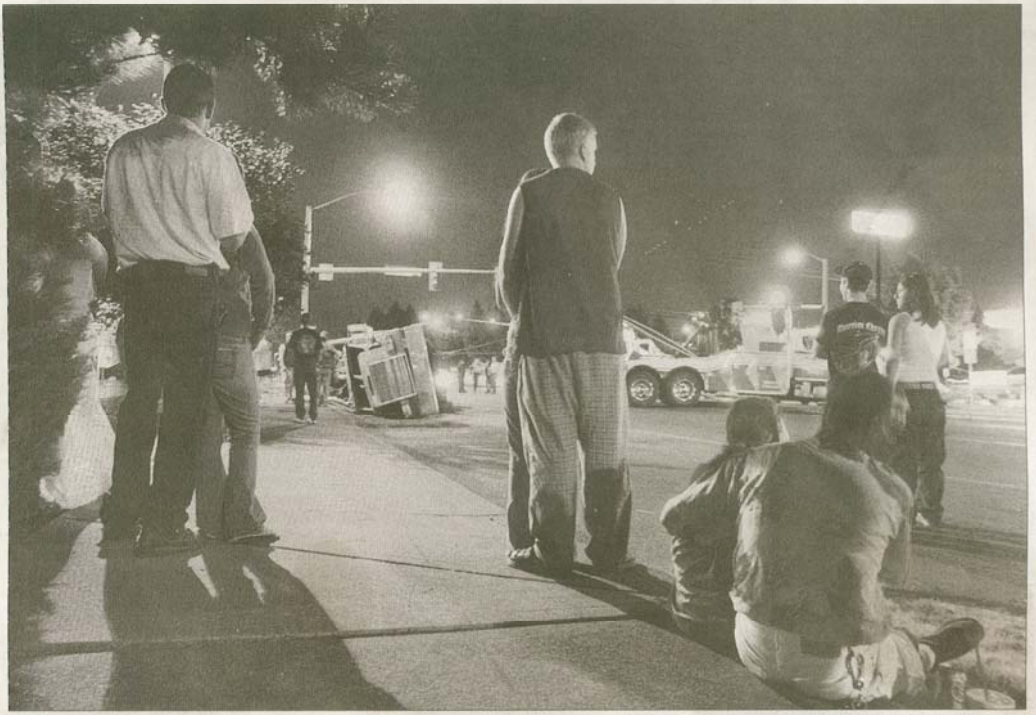
Canadian Sign for Trucks

AutoTurn Software

HO Scale Model Trucks

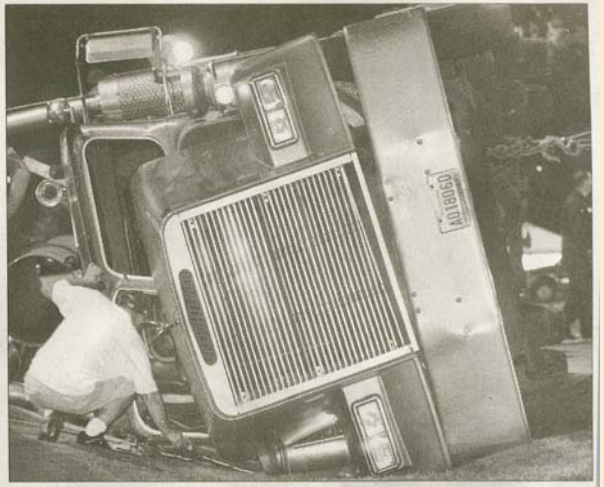
Truck Accommodation

Tipped truck draws a crowd on Martin Way



Photos by Tony Overman/The Olympian

Spectators (above) line Martin Way as they watch tow truck crews prepare to right an overturned tractor-trailer Thursday night. From left are Heath Howerton and Susie Greene, Cory Thompson and Christina Wilson, and Doris Paulson and David Jerome (sitting). "The funny thing is, we were wondering, 'What are we going to do tonight?' " Paulson said. "We were driving past and said: 'Hey! Some entertainment.' " The driver (right) of the big rig hauling metal pipes that overturned at Martin Way and Sleater-Kinney Road retrieves some belongings as tow truck crews prepare to right the truck. The 7:36 p.m. crash occurred when his load shifted as he rounded the corner, which caused the truck to tip and the tires to blow, Olympia traffic officer Randy Wilson said. The truck is owned by Stan Fye Trucking of Shelton. All but one lane of Martin Way was blocked for about 3 1/2 hours.



Trucks Tipping?

Corridor Applications

- Golden, CO Story (South Golden Road)
- Chehalis, WA – Chamber Way 2006
- SR 539 (Guide Meridian - Whatcom County 2008


Eggspress Lane
McDonald's
AIR

SR 539 (Guide Meridian)

Bellingham

Programming/Priority/HAL's/HAC's

West Lake Sammamish Parkway Story

Interchange Area

1997 Temporary Project


ONE WAY
ONE WAY
YIELD
YIELD


ONE WAY
STOP
HERE ON
RED

Ramp Meter Setup

Adjacent Ramp Meter


CROSSWALK

Meter “Off”

Meter “On”

Observing “metered” flow

1997 Temporary Project

Outreach


2/2/2005


YIELD
ONE WAY


ONE
WAY
SWIFT
YIELD

Washington State Law regarding fault in roundabout crashes

Washington State Roundabout Status

- 86 “bonafide” roundabouts as of Feb 2006
- A good mix of WSDOT, city and county
- Construction will add 10 – 15 more roundabouts in 2006
- More than 50 in design
- How many don’t we know about?

Questions/Comments?